

CLAIM(S)

What is claimed is :

1. A process for the preparation of polymers in sc fluids as  
5 reaction medium from at least two copolymerisable ethylenically  
unsaturated monomers and conventional initiators and regulators,  
characterised in that
- the reaction is carried out in the homogeneous phase,
  - after the reaction has ended, the reaction mixture is converted to a  
10 polymer powder by depressurising and removing the sc fluid.
- 2: A process according to claim 1, characterised in that
- after the reaction has ended, either further sc fluid is added or the  
15 phase parameters pressure or temperature are altered so that at least  
two phases are formed, a phase I containing predominantly polymer  
and sc fluid and the other phase II containing predominantly unreacted  
monomers and sc fluid, wherein, without departing from the sc phase  
conditions,
  - phase I is separated and
  - the polymer from phase I is converted to a polymer powder by  
20 depressurising and removing the sc fluid.
- 3: A process according to claim 1 and 2, characterised in that non  
reactive supercritical solvents are used as sc fluid.
- 25 4: A process according to claim 1 to 3, characterised in that at  
least three copolymerisable ethylenically unsaturated monomers are used,  
at least one monomer containing a further functional group.
- 30 5: A process according to claim 1 to 4, characterised in that up to  
20 wt-% of an organic solvent is added to the supercritical fluid.
- 6: A process according to claim 1 to 5, characterised in that the  
35 pressure is from 80 to 450 bar and the temperature is from 70 to 250°C.
- 7: A process according to claim 1 to 6, characterised in that the  
reaction is carried out batchwise.

8: A process according to claim 1 to 6, characterised in that the process is carried out continuously.

5 9: A process according to claim 7 and 8, characterised in that volatile accompanying substances are separated from the resulting polymer powder when the sc fluid is depressurised.

10 10: A process according to claim 7 and 8, characterised in that, prior to depressurisation, phase I is purified with a further separation step, preferably in a counter-current extraction process using an sc fluid.

11: A process according to claim 2, characterised in that phase II is separated and recycled to the polymerisation process.

15 12: A process according to claim 11, characterised in that monomers and accompanying substances are separated from phase II before the sc fluid is recycled.

20 13: A process for the preparation of powder coatings, characterised in that the polymer powder obtained according to claim 1 is manufactured as powder coating composition by well known techniques selected from the group consisting of the extruder process, the ultrasonic atomisation method, the method under assistance of sc fluids and the method of  
25 steam assisted micronisation.

14: A process according to claim 13, characterised in that additional components selected from the group consisting of hardeners, powder coating additives, dyes, pigments and extenders are used.

30 15: A process for the preparation of powder coatings, characterised in that the polymer is prepared in the homogeneous phase by reaction in the sc fluid according to a process according to claim 2,

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- the separated phase I optionally undergoes a further step for the separation of accompanying substances.
- phase I is further processed directly by the addition of further components of a powder coating, and
- the resulting process mixture is converted to a fine-particle solid powder coating by depressurising the sc fluid.

- 16: A process according to claim 15, characterised in that a hardener that reacts with the functional groups of the polymer is added as a further component.
- 17: A process according to claim 15 and 16, characterised in that further additives are added to the process mixture.
- 18: A process according to claim 12 and 15 to 17, characterised in that the added components, before being added and mixed, are homogenised in an identical or different sc fluid.
- 19: A process according to claim 15, characterised in that the process mixture is sprayed by means of a nozzle into a spray tower.
- 20: A process according to claim 15, characterised in that the process mixture is sprayed by means of a nozzle into a liquid, preferably aqueous medium
- 21: A process according to claim 15 to 20, characterised in that the sc fluid which is gaseous after spraying is purified and recycled to the process.
- 22: A process according to claim 15, characterised in that the polymer comprises at least three copolymerisable ethylenically unsaturated monomers, at least one monomer additionally containing further reactive functional groups, the dispersity of the binder is  $< 3$ , and contains further conventional binders, hardeners, auxiliaries and other additives.
- 23: Powder coating according to claim 22, characterised in that the average particle size is below 50  $\mu\text{m}$ .
- 24: Powder coating according to claim 23, characterised in that the powder coating is a powder clear coat.
- 25: Powder coating according to claim 23, characterised in that the powder coating is coloured with pigments and/or dyes.

26: The use of a powder coating according to claim 13 to 15 and 24 or 25 for use in multi-layer coating.

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27: The use according to claim 26 in the automotive industry.